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## N° IX.

*Experiments on Evaporation, and Meteorological Observations made at Bradford in New-England, in 1772, by the Rev. SAMUEL WILLIAMS, A. M.*

**I**N making experiments on the quantity of water that evaporated in the year 1771, the method I used, was to fill the vessel the beginning of every month: In the course of these experiments, I observed that in the beginning of the month when the tube was newly filled, it exhausted much faster than towards the latter end, when one or two inches of the water was evaporated; and that the quantity of evaporation measured this way, came out less than the quantity of rain that fell in the course of the year. The beginning of the year 1772, I attempted to examine this matter more carefully. With this view I made the following experiments.

## E X P E R I M E N T I.

I procured two cylindrical vessels of three inches diameter, and six deep, as much alike as they could be made: One, I filled with water as I had done in 1771, once a month; the other, with the same kind of water, once a week; and placed them about six inches apart, in such a manner as to be exposed to the wind, and sun, but covered from the rain. The result was, that which was filled once a week, exhausted about one third more than the other. In *January* and *February*, the difference was a little less; in *March* and *April*, it was a little more. In *May*, the last month in which I compared them, the evaporation from the former was 6.35 inches; from the other 4.10. By this experiment

experiment I was convinced that it never could be known with much accuracy by either of these methods, what quantity of water does really evaporate from the surface of seas, lakes and rivers. For in the one case, after about an inch is exhausted the surface of the water is too much sheltered from the wind, which greatly retards the evaporation. In the other, as the water has all the advantage of the wind, and is heated by the sun, and atmosphere, to a considerable greater degree than the water in seas, lakes and rivers, the quantity of evaporation comes out too much. And therefore nothing certain as to the real quantity of evaporation from watery fluids, can be determined by such experiments, however carefully they may be made.

## EXPERIMENT II.

To measure with more certainty the real quantity of evaporation, I attempted in the next place to examine what it was in fact from the surface of a river. This experiment was made in the following manner: I filled one of the vessels with river water, and placed it as before. The other I fixed in the centre of a circular board of three feet diameter. This instrument, by means of a line fastened to a tree on a small island, was placed so as to float near the middle of *Menimack* river. To defend the tube against the dews and rain, a circular piece of glass, fifteen inches diameter, was supported by wires fixed to the board, eight inches above the tube; and the whole was so balanced by weights as to leave half an inch of the tube above the surface of the water. When thus afloat I filled the tube with water, proposing to let it remain in this situation a week, to see how much would evaporate in that space of time. After repeated disappointments by the rain, wind and waves, for three months, I at last succeeded in trying the experiment from *August* 26th, to *September* 2d. During that time there was little wind,  
still

still water, no rain, nor any thing to disturb the experiment. The event was, that at the end of the seventh day, the tube was exhausted 1.15 inch. And that no water had got into the tube in that time, I was certain from this circumstance; all that part of the surface of the board which was within half a foot of the tube was dry every morning and evening. In the other tube, the evaporation in the same time was 1.50 inch; which gives 35 decimal parts of an inch difference between the real evaporation from the surface of the river, and that of the water when suspended in the air, as in the other vessel. All the evaporations therefore measured the latter of these ways, ought to be diminished in this proportion, to have the true quantity such as it is in nature.

### EXPERIMENT III.

These experiments on watery fluids put me upon enquiring what the evaporation was from the surface of the earth. To determine this, *Sept.* 14, two days after there had been any rain, I sunk one of the vessels into the earth in a light soil, so as to take up all the earth contained in a space equal to the contents of the vessel. Having carefully weighed the vessel with the earth it contained, I fixed it in the ground in a plain open field, where it was exposed to the sun and wind, but defended from the dew and rain, as in the former experiment. At the end of *seven days* I took it up, and weighing it again found it had lost 783 grains, *troy*. The diameter of the vessel being three inches, its surface expressed in whole numbers was equal to nine square inches. Dividing the number of grains that evaporated, 783, by the number of square inches contained in the surface of the vessel, 9, we shall have 87 grains for the evaporation from one square inch; and this, (assuming 254 grains as the weight of a cubic inch of water) will give  $\frac{3}{10}$  parts of an inch, as the depth of water that passed off by evaporation. In the other vessel filled with  
water,

## EXPERIMENTS ON EVAPORATION. 121

water, and placed as before, the evaporation in the same time was exactly one inch. If this experiment may be supposed to represent the operations of nature, the conclusion will be, that the evaporation from the surface of the earth, is but little more than *one third* of what the evaporation is from the surface of water.

### EXPERIMENT IV.

Another thing I had in view was to know what the evaporation was from plants and trees. In order to make an estimate of this, *August 20*, I took up four different sorts of plants, with as much of the earth adjoining to each as wholly covered their roots. Each plant, with the earth thus about it, being six inches square, I put into a wooden box of the same form and size. The boxes were covered with thin lead, well cemented at the joints, that nothing might evaporate that way; and had two apertures at the top; one, to admit the stem of the plant, the other, that the plant might be supplied with water, but which was kept stopped when not in use. Having taken the weight of each, I placed them in the ground that they might have the same degree of heat as before; leaving as much of the plant above the surface of the earth, as when it was in its natural state. In this situation I added known quantities of water, aiming to put in from time to time as much as I thought they would throw off. At the end of *thirty days* I took them up, taking an account of their weight as before, and also that of each plant. The result is expressed in the following particulars:

| <i>The several sorts<br/>of plants.</i> | <i>Weight of the<br/>plants.</i> |   |   |   |   |   | <i>Water evaporat-<br/>ed in 30 days.</i> |
|---|----------------------------------|---|---|---|---|---|---|
|   | Grains.                          |   |   |   |   |   | Grains.                                   |
| Apple tree, - - -                       | 23                               | - | - | - | - | - | 1271                                      |
| Alder tree, - - -                       | 30                               | - | - | - | - | - | 2593                                      |
| Spear mint, - - -                       | 22                               | - | - | - | - | - | 5186                                      |
| Clover, - - -                           | 43                               | - | - | - | - | - | 1894                                      |

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In this experiment, the evaporation from these four very small plants was 10944 grains; amounting to about 43 cubic inches of water, in thirty days. The evaporation in the same time from the vessel suspended in the air, was 4.25 inches in depth: The quantity therefore thrown off by the plants, was more than what the evaporation would have been from a watery surface, of ten inches square. If this way of reasoning may be applied to fields covered with trees, grafs, and other vegetables, the inference will be, that the evaporation for several months is greater from them, than it is from equal areas of the surface of water.

*METEOROLOGICAL OBSERVATIONS made  
at BRADFORD in 1772.*

THE instruments used in the following observations, the times at which they were taken, and the method in which they are set down, were described in the paper sent to the Society last year. With regard to those of the present year the following things are to be observed: The *barometrical* observations till Nov. 6, must be viewed as imperfect, being taken with a barometer of too small a bore. From the 6th of November to the end of the year, they are very exact; being taken by a very good barometer made by *Nairne*. In measuring the quantity of evaporation, I used a tube three inches diameter and six deep; which was filled once a week. The rain was measured by a tube of the same form and size. In all other respects, the same method was observed as in the meteorological observations of 1771.

The observations taken by the *barometer* and *thermometer* are set down in three columns; the first column contains the observations taken usually about 6<sup>h</sup> A. M. the second at noon, and the third at 9<sup>h</sup> P. M. The other columns give the general state of the winds and weather of the day.

J A N U -

# METEOROLOGICAL OBSERVATIONS. 123

JANUARY, 1772.

| Days. | Barometer. |       | Thermometer. |     | Winds.              | Weather.                                      |
|-------|------------|-------|--------------|-----|---------------------|---|
| I     | 30.04      | 30.1  | 18½          | 26½ | W. to S. W. little. | Fair day; snow in the night.                  |
| 2     | 30.14      | 30.1½ | 27           | 30  | W. little.          | Fine pleafant weather.                        |
| 3     | 29.7½      | 29.5  | 18           | 33  | S.                  | Cloudy day; rain in the night.                |
| 4     | 29.4       | 29.6  | 37½          | 41  | S. W.               | Fine pleafant weather.                        |
| 5     | 29.7½      | 29.7½ | 26           | 40  | N. W. ftrong.       | Clear bright day.                             |
| 6     | 29.9½      | 29.8  | 13           | 20  | N. W.               | Ditto. <i>Aurora Borealis</i> in the evening. |
| 7     | 30.1       | 30.0½ | 15½          | 22½ | W. to S.            | Cloudy, dull weather.                         |
| 8     | 30.1       | 30.1  | 23           | 29½ | W. little.          | Fine pleafant day.                            |
| 9     | 30.1½      | 30.1½ | 27           | 34  | Ditto.              | Ditto.  |
| 10    | 30.1½      | 30.1½ | 28½          | 26½ | Ditto.              | Ditto.  |
| 11    | 30.1½      | 30.1½ | 21           | 25  | Ditto.              | Cloudy day; snow in the night.                |
| 12    | 29.6       | 29.6  | 26           | 32  | E. freft.           | Flying clouds with bright intervals.          |
| 13    | 29.6       | 29.6  | 35           | 34½ | S. W. to W.         | Mild pleafant day.                            |
| 14    | 29.7½      | 29.8  | 28           | 30  | W. little.          | Ditto.  |
| 15    | 29.8       | 29.7½ | 23           | 25  | Ditto.              | Snow A. M. clear P. M.                        |
| 16    | 29.7½      | 29.6  | 23           | 28  | S. E. to W.         | Clear bright day.                             |
| 17    | 29.4½      | 29.5  | 21           | 20  | W.                  | Cloudy, with fome fnow.                       |
| 18    | 29.3½      | 29.2  | 10           | 18  | N.                  | Cloudy dull weather.                          |
| 19    | 29.1½      | 29.1  | 18           | 27  | N. to S. W.         | Storm of fnow, all day; bright evening.       |
| 20    | 28.9½      | 28.6½ | 27½          | 20  | N. to N. W.         | Fair weather.                                 |
| 21    | 28.9       | 29.2  | 11½          | 19  | N. W.               | Cloudy dull day.                              |
| 22    | 29.2       | 29.1½ | 18           | 28½ | S. E.               | Cloudy, with bright intervals.                |
| 23    | 29.0       | 29.0  | 28½          | 36½ | Ditto.              | Dull midling day.                             |
| 24    | 29.0½      | 29.0½ | 37           | 40  | W. little.          | Fine pleafant day.                            |
| 25    | 29.3½      | 29.3  | 38           | 30  | N. W.               | Ditto.  |
| 26    | 29.6       | 29.6½ | 23           | 26  | N.                  | Cloudy dull weather.                          |
| 27    | 29.5½      | 29.5  | 9            | 10½ | Ditto.              | Ditto, with rain.                             |
| 28    | 29.2       | 29.1½ | 7            | 17  | W. little.          | Fair and clear.                               |
| 29    | 29.3       | 29.3½ | 16½          | 23  | N. E. freft.        | Cloudy day; ftorm of fnow in the night.       |
| 30    | 29.0       | 28.6  | 20           | 32  | N. E. to S.         | Cloudy dull weather.                          |
| 31    | 28.7       | 28.9  | 26           | 34  |                     |   |

Quantity of rain in January, 2.00 } Inches.  
Quantity of water evaporated, 1.55 }

FEBRU-

## F E B R U A R Y, 1772.

| Days. | Barometer.         |                    |                    | Thermometer.     |                  | Winds.              | Weather.  |
|-------|--------------------|--------------------|--------------------|------------------|------------------|---------------------|---|
| 1     | 29,0 $\frac{3}{4}$ | 29,1               | 29,1 $\frac{1}{2}$ | 31               | 37               | S.                  | Fair A. M.; cloudy P. M.                        |
| 2     | 29,3 $\frac{1}{2}$ | 29,4               | 29,6 $\frac{1}{2}$ | 29               | 35               | W. little.          | Fine bright day.                                |
| 3     | 29,2               | 29,1 $\frac{1}{2}$ | 29,1 $\frac{1}{2}$ | 20               | 23               | E. fresh.           | Cl. day; hea. for. of fn. & hail in the nig.    |
| 4     | 28,9               | 29,2 $\frac{3}{4}$ | 29,4 $\frac{1}{2}$ | 26               | 32               | S. to N. W. fresh.  | Dull cloudy day.                                |
| 5     | 29,7 $\frac{1}{2}$ | 29,7 $\frac{1}{2}$ | 29,9 $\frac{1}{2}$ | 21 $\frac{1}{2}$ | 23 $\frac{1}{2}$ | N. W. fresh.        | Flying clouds, with bright intervals.           |
| 6     | 30,1               | 30,1 $\frac{1}{2}$ | 30,1 $\frac{1}{2}$ | 14 $\frac{1}{2}$ | 20 $\frac{1}{2}$ | N. W. little.       | Fine bright day. <i>Aur. Bor.</i> in the night. |
| 7     | 30,2 $\frac{1}{4}$ | 29,9 $\frac{3}{4}$ | 30,0 $\frac{1}{4}$ | 23               | 31               | S. W. to W.         | Fine pleafant weather.                          |
| 8     | 30,2 $\frac{1}{4}$ | 29,9 $\frac{3}{4}$ | 30,2 $\frac{1}{4}$ | 30,0             | 25               | N. to E. S. E.      | Cloudy dull day.                                |
| 9     | 29,4 $\frac{1}{4}$ | 29,1               | 29,4 $\frac{1}{4}$ | 37               | 40               | S. to W. fresh.     | Rainy A. M.; cloudy P. M. bright even.          |
| 10    | 29,7 $\frac{1}{2}$ | 29,9               | 29,9 $\frac{1}{2}$ | 22               | 25 $\frac{1}{2}$ | N. W. fresh.        | Fair and clear.                                 |
| 11    | 30,0               | 29,6 $\frac{1}{2}$ | 30,0               | 25               | 30               | S. W. to W. fresh.  | Ditto.  |
| 12    | 30,2 $\frac{3}{4}$ | 30,2               | 30,3 $\frac{1}{4}$ | 19 $\frac{1}{2}$ | 14               | N. W.               | Fair day.                                       |
| 13    | 30,4               | 30,4               | 30,4               | 3                | 11               | N. W. to N. E.      | Fair day; cloudy evening.                       |
| 14    | 30,2               | 29,9               | 29,9 $\frac{1}{2}$ | 11 $\frac{1}{2}$ | 12 $\frac{1}{2}$ | N. to W.            | Snow A. M.; clear P. M.                         |
| 15    | 30,1 $\frac{1}{2}$ | 29,2               | 29,2               | 7 $\frac{1}{2}$  | 14               | W. to E.            | Cl. A. M.; fn. with ra. P. M. & in the nig.     |
| 16    | 29,2 $\frac{1}{4}$ | 29,1               | 29,1 $\frac{1}{4}$ | 27               | 32               | S. W. little.       | Fair pleafant day.                              |
| 17    | 29,6               | 29,6               | 29,6               | 16 $\frac{1}{2}$ | 26               | W. to S. W. fresh.  | Flying clouds, with bright intervals.           |
| 18    | 29,6               | 29,6               | 29,6               | 25               | 34               | S. W. little.       | Fine pleafant day.                              |
| 19    | 29,6 $\frac{1}{2}$ | 29,6 $\frac{1}{2}$ | 29,6 $\frac{1}{2}$ | 36 $\frac{1}{2}$ | 39               | S. W.               | Ditto.  |
| 20    | 29,6 $\frac{1}{2}$ | 29,6 $\frac{1}{2}$ | 29,6 $\frac{1}{2}$ | 40 $\frac{1}{2}$ | 44 $\frac{1}{2}$ | Ditto.              | Cloudy day; rain in the night.                  |
| 21    | 29,2 $\frac{3}{4}$ | 29,4               | 29,6               | 49 $\frac{1}{2}$ | 51               | W. S. W.            | Fine pleafant day.                              |
| 22    | 29,5 $\frac{3}{4}$ | 29,2 $\frac{1}{2}$ | 29,5               | 44               | 47 $\frac{1}{2}$ | Ditto. fresh.       | Ditto.  |
| 23    | 29,6               | 29,6               | 29,6               | 42               | 43               | W.                  | Ditto.  |
| 24    | 29,8 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 38               | 40               | S. W. to E.         | Ditto.  |
| 25    | 29,5 $\frac{1}{2}$ | 29,0               | 28,4 $\frac{1}{2}$ | 35               | 34               | N. E. to S. strong. | Heavy form of frow and rain all day.            |
| 26    | 28,6               | 28,6 $\frac{1}{2}$ | 28,6 $\frac{1}{2}$ | 29,1             | 32               | W. to N. strong.    | Flying clouds, with bright intervals.           |
| 27    | 29,3 $\frac{1}{2}$ | 29,3 $\frac{1}{2}$ | 29,3 $\frac{1}{2}$ | 29,1             | 33               | W.                  | Fine pleafant day. <i>Aur. Bor.</i> in the nig. |
| 28    | 29,3 $\frac{1}{2}$ | 29,4               | 29,4               | 31               | 37               | S. W. little.       | Ditto.  |
| 29    | 29,2               | 29,2               | 29,3 $\frac{1}{2}$ | 37               | 39               | Ditto. fresh.       | Ditto.  |

Quantity of rain in February, 2,40 } Inches.  
Quantity of water evaporated, 1,65 }

MARCH,



# METEOROLOGICAL OBSERVATIONS. 125

MARCH, 1772.

| Days. | Barometer.         |                    | Thermometer.       |                  | Winds.              | Weather.                                    |
|-------|--------------------|--------------------|--------------------|------------------|---------------------|---|
| 1     | 29.0 $\frac{1}{2}$ | 29.5               | 29.4 $\frac{1}{2}$ | 30               | N. W. to S.         | Fair weather.                               |
| 2     | 29.0               | 29.3 $\frac{1}{2}$ | 29.4               | 31               | S. W. little.       | Fine bright day.                            |
| 3     | 29.0               | 29.9               | 29.9 $\frac{1}{2}$ | 33               | N. E.               | Cloudy dull weather.                        |
| 4     | 29.0 $\frac{1}{2}$ | 30.0               | 30.0               | 32               | N. to W. little.    | Fine pleasant day.                          |
| 5     | 29.8               | 29.4               | 28.8               | 33               | N. E. strong.       | Heavy storm of snow.                        |
| 6     | 28.8               | 29.1               | 29.4               | 27               | W. fresh.           | Clear pleasant weather.                     |
| 7     | 28.8               | 29.8               | 29.8               | 25               | W. little.          | Ditto.                                      |
| 8     | 29.9               | 29.9               | 29.9 $\frac{1}{2}$ | 34               | Ditto.              | Ditto.                                      |
| 9     | 30.2               | 30.1 $\frac{1}{2}$ | 30.0 $\frac{1}{2}$ | 20 $\frac{1}{2}$ | N. fresh.           | Cloudy with some snow.                      |
| 10    | 30.0               | 30.0               | 30.0               | 25               | E. little.          | Fine pleasant day.                          |
| 11    | 29.7 $\frac{1}{2}$ | 29.5               | 28.8               | 31               | N. N. E.            | Clo. A. M.; heavy storm of snow P. M.       |
| 12    | 28.7               | 29.2 $\frac{1}{2}$ | 29.8               | 32               | W. fresh.           | Cloudy morning; clear bright day.           |
| 13    | 29.8               | 29.8               | 29.8               | 26               | N.                  | Cloudy with some snow.                      |
| 14    | 29.8               | 29.8               | 30.0 $\frac{1}{2}$ | 20               | W.                  | Clear bright day.                           |
| 15    | 30.2               | 30.2               | 30.2               | 23               | Ditto.              | Ditto.                                      |
| 16    | 30.2               | 30.1               | 29.6 $\frac{1}{2}$ | 25               | W. to S. fresh.     | Dull cloudy weather.                        |
| 17    | 29.6               | 29.7               | 29.8 $\frac{1}{2}$ | 28               | W. to S. fresh.     | Clear bright day.                           |
| 18    | 30.0               | 30.0               | 29.6 $\frac{1}{2}$ | 35               | W. to S.            | Clear A. M.; cloudy P. M.                   |
| 19    | 29.6               | 29.4               | 29.4 $\frac{1}{2}$ | 39 $\frac{1}{2}$ | S. W. to S. E.      | Ditto.                                      |
| 20    | 29.4 $\frac{1}{2}$ | 29.2 $\frac{1}{2}$ | 29.1               | 34               | N. E. to N.         | Clo. mor. flor. of sn. P. M. & in the even. |
| 21    | 28.9               | 28.9               | 29.0 $\frac{1}{2}$ | 38               | W. S. W. fresh.     | Cloudy weather.                             |
| 22    | 29.3               | 29.3               | 29.5 $\frac{1}{2}$ | 42               | Ditto.              | Flying clouds, with bright intervals.       |
| 23    | 29.6               | 29.6               | 29.6               | 47               | S. little.          | Fine pleasant day.                          |
| 24    | 29.6               | 29.0               | 29.6               | 45               | S. to S. E.         | Cloudy weather.                             |
| 25    | 29.6               | 29.6               | 29.6               | 42               | S. to E. little.    | Fine pleasant day.                          |
| 26    | 29.6               | 29.6               | 29.6               | 39               | N. to S. E. little. | Dull misting weather.                       |
| 27    | 29.6               | 29.6               | 29.6               | 42               | S. to E. little.    | Fine pleasant weather.                      |
| 28    | 29.7 $\frac{1}{2}$ | 29.7 $\frac{1}{2}$ | 29.7 $\frac{1}{2}$ | 37 $\frac{1}{2}$ | E. to N. E. fresh.  | Cloudy day; rainy evening and night.        |
| 29    | 29.2 $\frac{1}{2}$ | 29.2               | 29.2               | 36               | E. fresh            | Heavy storm of snow & rain, all day.        |
| 30    | 29.3               | 29.4               | 29.5 $\frac{1}{2}$ | 35 $\frac{1}{2}$ | N. N. E.            | Rainy weather.                              |
| 31    | 29.8               | 29.9               | 29.8 $\frac{1}{2}$ | 39 $\frac{1}{2}$ | N. to E. little.    | Fine pleasant day.                          |

Quantity of rain in March,  $4\frac{1}{2}$  Inches.  
Quantity of water evaporated,  $1\frac{1}{4}$  Inches.

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APRIL,

APRIL, 1772.

| Days. | Barometer.         |                    | Thermometer.     |                  | Winds.              | Weather.                                     |
|-------|--------------------|--------------------|------------------|------------------|---------------------|--|
| 1     | 29.8               | 29.8               | 35               | 46 $\frac{1}{2}$ | S. little.          | Fine pleafant weather.                       |
| 2     | 29.7 $\frac{1}{2}$ | 29.5 $\frac{1}{2}$ | 37               | 38 $\frac{1}{2}$ | N. E. freh.         | Cloudy dull day.                             |
| 3     | 29.3 $\frac{1}{2}$ | 29.3 $\frac{1}{2}$ | 35               | 36               | N. strong.          | Ditto, with fome fnow.                       |
| 4     | 29.6               | 29.7               | 33               | 39 $\frac{1}{2}$ | N. to W. little.    | Cloudy A. M.—fair and pleafant P. M.         |
| 5     | 29.8               | 29.8               | 33 $\frac{1}{2}$ | 44               | W. to S. W. little. | Fine pleafant weather.                       |
| 6     | 29.5               | 29.4               | 41 $\frac{1}{2}$ | 50 $\frac{1}{2}$ | E. little.          | Ditto.                                       |
| 7     | 29.5 $\frac{1}{2}$ | 29.5 $\frac{1}{2}$ | 39               | 54               | S. E. little.       | Ditto.                                       |
| 8     | 29.5 $\frac{1}{2}$ | 29.4               | 41 $\frac{1}{2}$ | 50               | E.                  | Clear A. M. clou. P. M. and in the night.    |
| 9     | 29.2 $\frac{1}{2}$ | 29.0               | 42               | 39 $\frac{1}{2}$ | N. E. to N. strong. | Storm of rain all day.                       |
| 10    | 29.2 $\frac{1}{2}$ | 29.2 $\frac{1}{2}$ | 40               | 50               | N. W. to S. W.      | Fine pleafant day.                           |
| 11    | 29.2 $\frac{1}{2}$ | 29.2 $\frac{1}{2}$ | 46               | 57               | S. W. to S. little. | Fair day; clo. evening; fmall fhowers in the |
| 12    | 29.0               | 29.0               | 47               | 48               | S. W. to W. freh.   | Fair weather. <i>Aur. Bor.</i> in the night. |
| 13    | 29.2               | 29.2               | 41               | 46               | Variable.           | Cloudy dull day.                             |
| 14    | 29.2               | 29.3 $\frac{1}{2}$ | 40               | 48 $\frac{1}{2}$ | S. W. freh.         | Flying clouds, with bright intervals.        |
| 15    | 29.6               | 29.6               | 41 $\frac{1}{2}$ | 49               | W. by S.            | Fine bright day; rain in the night.          |
| 16    | 29.8               | 29.5 $\frac{1}{2}$ | 44               | 47               | S. to S. E.         | Rainy all day.                               |
| 17    | 29.4               | 29.5 $\frac{1}{2}$ | 48 $\frac{1}{2}$ | 52               | S. E. to W. little. | Fair pleafant weather.                       |
| 18    | 29.9 $\frac{1}{2}$ | 30.0               | 43               | 53               | W. little.          | Ditto.                                       |
| 19    | 30.1               | 30.0 $\frac{1}{2}$ | 42               | 44               | N. E.               | Fair A. M. cloudy P. M.                      |
| 20    | 29.8               | 29.1 $\frac{1}{2}$ | 36               | 38               | NE to NW strong.    | Storm of rain 'till 4 P. M. clou. evening.   |
| 21    | 29.4 $\frac{1}{2}$ | 29.5               | 38 $\frac{1}{2}$ | 44               | N. W. freh.         | Fair A. M. fhowers P. M. & in the even.      |
| 22    | 29.7               | 29.4 $\frac{1}{2}$ | 43 $\frac{1}{2}$ | 55               | S. W.               | Fine pleafant day.                           |
| 23    | 29.3               | 29.1               | 51               | 58               | S. to W. freh.      | Fair A. M. fhowers P. M. and in the even.    |
| 24    | 29.2               | 29.2               | 45               | 49               | Variable.           | Dull cloudy day.                             |
| 25    | 29.5               | 29.5               | 41               | 48 $\frac{1}{2}$ | N. E. to W.         | Ditto.                                       |
| 26    | 29.5 $\frac{1}{2}$ | 29.6               | 39 $\frac{1}{2}$ | 55               | W. to S. E.         | Fine pleafant day.                           |
| 27    | 29.7 $\frac{1}{2}$ | 29.5 $\frac{1}{2}$ | 50               | 64 $\frac{1}{2}$ | S. little.          | Ditto.                                       |
| 28    | 29.6               | 29.6               | 57 $\frac{1}{2}$ | 62               | Ditto.              | Ditto.                                       |
| 29    | 29.8               | 29.8 $\frac{1}{2}$ | 54               | 60               | E. freh.            | Ditto.                                       |
| 30    | 29.8               | 29.6               | 53               | 65 $\frac{1}{2}$ | S. W.               | Ditto.                                       |

Quantity of rain in April, 2.90 } Inches.  
Quantity of water evaporated, 3.45 }

MAY,

# METEOROLOGICAL OBSERVATIONS. 127

M A Y, 1772.

| Days. | Barometer.         |                    | Thermometer.       |                  | Winds.            | Weather.                                  |
|-------|--------------------|--------------------|--------------------|------------------|-------------------|---|
| 1     | 29.6               | 29.5 $\frac{1}{2}$ | 29.3               | 77 $\frac{1}{2}$ | S. W.             | Fair weather.                             |
| 2     | 29.3               | 29.3               | 29.3               | 75               | Ditto fresh.      | Do. Lightg. in the night, with thund.     |
| 3     | 29.8               | 29.9               | 30.0               | 54               | N. W.             | Do. with bright intervals.                |
| 4     | 30.2               | 30.2               | 30.1 $\frac{1}{2}$ | 59               | E.                | Clear A. M. clou. P. M. & in the evening. |
| 5     | 30.1 $\frac{1}{2}$ | 30.1 $\frac{1}{2}$ | 29.9 $\frac{1}{2}$ | 51               | S. E.             | Dull cloudy weather.                      |
| 6     | 29.9 $\frac{1}{2}$ | 29.8 $\frac{1}{2}$ | 29.5 $\frac{1}{2}$ | 50 $\frac{1}{2}$ | Variable.         | Fine pleafant day.                        |
| 7     | 30.0               | 30.0               | 47 $\frac{1}{2}$   | 55               | E.                | Ditto.                                    |
| 8     | 30.0               | 29.9               | 20.5               | 52               | N. E. to N. N. W. | Cloudy A. M. rainy P. M. & in the night.  |
| 9     | 29.1               | 29.1               | 49.2               | 51               | S. W. fresh.      | Fair A. M. small showers P. M.            |
| 10    | 29.4 $\frac{1}{2}$ | 29.4 $\frac{1}{2}$ | 49.7               | 55               | N. W. fresh.      | Fair and pleafant.                        |
| 11    | 29.8 $\frac{1}{2}$ | 29.8 $\frac{1}{2}$ | 43                 | 53               | W.                | Ditto.                                    |
| 12    | 29.8               | 29.7               | 29.6 $\frac{1}{2}$ | 62               | Variable.         | Cloudy A. M. rainy P. M.                  |
| 13    | 29.7 $\frac{1}{2}$ | 29.7 $\frac{1}{2}$ | 50                 | 56               | W.                | Clear and pleafant.                       |
| 14    | 29.8 $\frac{1}{2}$ | 29.8               | 49                 | 56               | Ditto.            | Ditto.                                    |
| 15    | 29.6 $\frac{1}{2}$ | 29.5 $\frac{1}{2}$ | 63                 | 63               | S. W. little.     | Ditto.                                    |
| 16    | 29.3 $\frac{1}{2}$ | 29.3 $\frac{1}{2}$ | 67                 | 64               | Ditto.            | Ditto.                                    |
| 17    | 29.3               | 29.3               | 52                 | 60               | Variable.         | Ditto.                                    |
| 18    | 29.5               | 29.5               | 54                 | 59               | E.                | Cloudy A. M. rainy P. M.                  |
| 19    | 29.4 $\frac{1}{2}$ | 29.5               | 53                 | 60               | N. E.             | Fair day ; cloudy evening.                |
| 20    | 29.3 $\frac{1}{2}$ | 29.1 $\frac{1}{2}$ | 54                 | 57               | S. W. to N. W.    | Small showers A. M. cloudy P. M.          |
| 21    | 29.5               | 29.5 $\frac{1}{2}$ | 49 $\frac{1}{2}$   | 59 $\frac{1}{2}$ | N. W.             | Fine pleafant day.                        |
| 22    | 29.5               | 29.5               | 56                 | 65               | S. W. fresh.      | Ditto.                                    |
| 23    | 29.7               | 29.5               | 57                 | 71               | Ditto.            | Ditto.                                    |
| 24    | 29.3 $\frac{1}{2}$ | 29.2               | 65                 | 64               | S. W. to N. E.    | Fair till 3 P. M. cloudy evening & night. |
| 25    | 29.3 $\frac{1}{2}$ | 29.5               | 53                 | 56               | N. to N. E.       | Dull cloudy day.                          |
| 26    |                    |                    |                    | 57               | Ditto.            | Ditto.                                    |
| 27    |                    |                    |                    |                  | Ditto.            | Ditto.                                    |
| 28    | 29.7               | 29.7 $\frac{1}{2}$ | 55                 | 56 $\frac{1}{2}$ | N. E. to S. W.    | Small showers.                            |
| 29    | 29.7               | 29.6 $\frac{1}{2}$ | 55                 | 61               | S. W. to N.       |   |
| 30    | 29.3 $\frac{1}{2}$ | 29.4               | 63                 | 66               | N. W. to S.       |   |
| 31    |                    |                    |                    | 75               | S. W. fresh.      |   |

Quantity of rain in May, 1.00  
Quantity of water evaporated, 6.35 } Inches.

JUNE,

JUNE, 1772.

| Days. | Barometer.         |                    |                    | Thermometer.     |                  | Winds.             | Weather.                                 |
|-------|--------------------|--------------------|--------------------|------------------|------------------|--------------------|--|
| 1     | 29.4               | 29.4               | 29.4               | 65               | 77               | S. W. fresh.       | Fair day; thun. & lighten. in the night. |
| 2     | 29.5               | 29.5 $\frac{1}{2}$ | 29.6 $\frac{1}{2}$ | 64               | 60               | N. E.              | Dull cloudy weather.                     |
| 3     | 29.7 $\frac{1}{2}$ | 29.8               | 29.9 $\frac{1}{2}$ | 55               | 59 $\frac{1}{2}$ | Ditto.             | Fine pleasant day.                       |
| 4     | 30.0               | 30.1               | 30.0 $\frac{1}{2}$ | 51               | 64               | N. W.              | Ditto.                                   |
| 5     | 30.1               | 30.1               | 30.0 $\frac{1}{2}$ | 55 $\frac{1}{2}$ | 73               | W. to S. S. W.     | Ditto.                                   |
| 6     | 30.0 $\frac{1}{2}$ | 29.7 $\frac{3}{4}$ | 29.6 $\frac{1}{2}$ | 61               | 78               | S. W. to N. N. E.  | Ditto.                                   |
| 7     | 29.6 $\frac{1}{2}$ | 29.5               | 29.6               | 63 $\frac{1}{2}$ | 72 $\frac{1}{2}$ | S. W. to N. N. E.  | Ditto.                                   |
| 8     | 29.5 $\frac{1}{2}$ | 29.5               | 29.6               | 62               | 71 $\frac{1}{2}$ | S. S. W.           | Ditto.                                   |
| 9     | 29.8 $\frac{1}{2}$ | 29.8               | 29.8 $\frac{1}{2}$ | 55 $\frac{1}{2}$ | 62               | W.                 | Ditto.                                   |
| 10    | 29.8 $\frac{1}{2}$ | 29.8 $\frac{1}{2}$ | 29.8 $\frac{1}{2}$ | 55               | 62               | W. to N. E.        | Fair A. M.; cloudy P. M.                 |
| 11    | 29.7 $\frac{1}{2}$ | 29.7               | 29.6               | 55               | 58               | N. E. to S. S. E.  | Cloudy day; flowers in the night.        |
| 12    | 29.3               | 29.4 $\frac{1}{2}$ | 29.6 $\frac{1}{2}$ | 57               | 64               | W. fresh.          | Fine bright day.                         |
| 13    | 29.6               | 29.6 $\frac{1}{2}$ | 29.6               | 54 $\frac{1}{2}$ | 67               | Ditto.             | Ditto.                                   |
| 14    | 29.6               | 29.6               | 29.6               | 65               | 77               | S. W.              | Ditto. lightening in the evening.        |
| 15    | 29.6               | 29.5               | 29.4               | 73               | 83               | S. W. fresh.       | Ditto.                                   |
| 16    | 29.3 $\frac{1}{2}$ | 29.3 $\frac{1}{2}$ | 29.5               | 69 $\frac{1}{2}$ | 73               | S. W. to W. fresh. | Cloudy A. M.; rainy P. M.                |
| 17    | 29.5               | 29.5               | 29.5               | 62               | 66               | N.                 | Cloudy dull day.                         |
| 18    | 29.5               | 29.4 $\frac{1}{2}$ | 29.5               | 60               | 61 $\frac{1}{2}$ | Ditto.             | Rainy day.                               |
| 19    | 29.4 $\frac{1}{2}$ | 29.4 $\frac{1}{2}$ | 29.4               | 58 $\frac{1}{2}$ | 63 $\frac{1}{2}$ | Ditto.             | Ditto.                                   |
| 20    | 29.3 $\frac{1}{2}$ | 29.4               | 29.3 $\frac{1}{2}$ | 57               | 62               | Ditto.             | Ditto. Fair evening.                     |
| 21    | 29.4               | 29.3 $\frac{1}{2}$ | 29.4               | 59               | 67 $\frac{1}{2}$ | N. to E.           | Cloudy dull day.                         |
| 22    | 29.4 $\frac{1}{2}$ | 29.4 $\frac{1}{2}$ | 29.3 $\frac{1}{2}$ | 56               | 54               | N. E.              | Cloudy, with flowers.                    |
| 23    | 29.3 $\frac{1}{2}$ | 29.4               | 29.4               | 53               | 61               | N. to W.           | Flying clouds with bright intervals.     |
| 24    | 29.4               | 29.4               | 29.4               | 64               | 69               | Ditto.             | Ditto.                                   |
| 25    | 29.4 $\frac{1}{2}$ | 29.4 $\frac{1}{2}$ | 29.4               | 66 $\frac{1}{2}$ | 74               | Ditto.             | Ditto.                                   |
| 26    | 29.4 $\frac{1}{2}$ | 29.3 $\frac{1}{2}$ | 29.3 $\frac{1}{2}$ | 62 $\frac{1}{2}$ | 59               | N. W. to E.        | Cloudy, with rain.                       |
| 27    | 29.4               | 29.3 $\frac{1}{2}$ | 29.6               | 63               | 71               | N. W. fresh.       | Flying clouds, with bright intervals.    |
| 28    | 29.7 $\frac{1}{2}$ | 29.8               | 29.8 $\frac{1}{2}$ | 70               | 76               | W.                 | Fine pleasant weather.                   |
| 29    | 29.8 $\frac{1}{2}$ | 29.8               | 29.7               | 82               | 82               | S. W.              | Ditto.                                   |
| 30    | 29.8               | 29.7               | 29.6               | 70               | 83 $\frac{1}{2}$ | Ditto.             | Ditto.                                   |

Quantity of rain in June, 1.25 } Inches.  
Quantity of water evaporated, 5.45 }

JULY,

JULY, 1772.

| Days. | Barometer.         |                    |                    | Thermometer.     |                  | Winds.           | Weather.  |
|-------|--------------------|--------------------|--------------------|------------------|------------------|------------------|---|
| 1     | 29.4               | 29.4               | 29.4               | 74               | 78               | S. W.            | Small showers A. M. fair & pleas. P. M.           |
| 2     | 29.4               | 29.4               | 29.4               | 71               | 77               | Ditto.           | Cloudy, with small flowers.                       |
| 3     | 29.4 $\frac{1}{2}$ | 29.4 $\frac{1}{2}$ | 29.4               | 71               | 77               | N. to E.         | Ditto, lightening in the evening.                 |
| 4     | 29.3 $\frac{1}{2}$ | 29.3 $\frac{1}{2}$ | 29.2 $\frac{1}{2}$ | 71               | 78 $\frac{1}{2}$ | S. W. to W.      | Ditto.  |
| 5     | 29.6               | 29.6 $\frac{1}{2}$ | 29.6               | 73 $\frac{1}{2}$ | 80 $\frac{1}{2}$ | W.               | Fine pleas. day. <i>Aur. Bor.</i> in the evening. |
| 6     | 29.6               | 29.6               | 29.6               | 71 $\frac{1}{2}$ | 81               | S. W.            | Fair A. M.; cloudy P. M.                          |
| 7     | 29.8               | 29.7 $\frac{1}{2}$ | 29.5 $\frac{1}{2}$ | 72               | 80               | S. W. strong.    | Fair till 2 P. M. clou. with th. & ra. nig.       |
| 8     | 29.2 $\frac{1}{2}$ | 29.2               | 29.4 $\frac{1}{2}$ | 77               | 79               | S. W. to N. W.   | Fair day. <i>Aur. Bor.</i> in the night.          |
| 9     | 29.6               | 29.6               | 29.6               | 77               | 81               | W.               | Fine pleasant day.                                |
| 10    | 29.6               | 29.6               | 30.0               | 66               | 77               | Ditto.           | Fair A. M. shower of rain and hail P. M.          |
| 11    | 30.1               | 30.1               | 30.1               | 62               | 74               | Ditto.           | Fine pleasant day.                                |
| 12    | 30.0 $\frac{1}{2}$ | 30.0               | 30.0               | 78               | 74               | Ditto.           | Ditto.  |
| 13    | 29.9               | 29.9 $\frac{1}{2}$ | 29.9 $\frac{1}{2}$ | 70               | 73               | W. to S. little. | Ditto.  |
| 14    | 29.9               | 29.9               | 29.9 $\frac{1}{2}$ | 70               | 78               | S. W.            | Fair A. M. a small shower P. M.                   |
| 15    | 29.6               | 29.6 $\frac{1}{2}$ | 29.6 $\frac{1}{2}$ | 73               | 77 $\frac{1}{2}$ | Ditto.           | Cloudy, dull weather.                             |
| 16    | 29.6               | 29.6 $\frac{1}{2}$ | 29.6               | 71               | 76               | Ditto.           | Cloudy, with bright intervals.                    |
| 17    | 29.6 $\frac{1}{2}$ | 29.6 $\frac{1}{2}$ | 29.6               | 74               | 78               | Ditto.           | Fine pleasant weather.                            |
| 18    | 29.8               | 29.9               | 29.9               | 65               | 72               | Ditto.           | Fair A. M. cloudy P. M.                           |
| 19    | 29.9 $\frac{1}{2}$ | 30.0               | 29.9 $\frac{1}{2}$ | 72               | 71               | Ditto.           | Fine pleasant day.                                |
| 20    | 30.1 $\frac{1}{2}$ | 30.1 $\frac{1}{2}$ | 30.1               | 72               | 70               | Ditto.           | Fair A. M. cloudy P. M. rain in the night.        |
| 21    | 30.1               | 30.0 $\frac{1}{2}$ | 29.9               | 68               | 75               | Ditto.           | Fair A. M. clear P. M.                            |
| 22    | 30.1               | 29.7               | 29.7               | 66               | 73               | Ditto.           | Cloudy A. M. clear P. M.                          |
| 23    | 29.5               | 29.5               | 29.6               | 65               | 75               | N. E. to W.      | Ditto.  |
| 24    | 29.6               | 29.6               | 29.6 $\frac{1}{2}$ | 68               | 75               | Variable.        | Cloudy, with thunder and rain.                    |
| 25    | 29.8 $\frac{1}{2}$ | 29.9               | 30.0               | 73               | 72               | W. to N.         | Pleasant day. Rem. <i>Aur. Bor.</i> in the nig.   |
| 26    | 30.0 $\frac{1}{2}$ | 30.0               | 29.7               | 74               | 80 $\frac{1}{2}$ | S. W. to N.      | Fair pleasant weather.                            |
| 27    | 29.8 $\frac{1}{2}$ | 29.8               | 29.6 $\frac{1}{2}$ | 76               | 79               | S. to S. W.      | Ditto. Lightening in the evening.                 |
| 28    | 29.8               | 29.6               | 29.4               | 78               | 87               | Ditto.           | Ditto.  |
| 29    | 29.5               | 29.3               | 29.3               | 81 $\frac{1}{2}$ | 95 $\frac{1}{2}$ | Ditto.           | Ditto.  |
| 30    | 29.4               | 29.3               | 29.3               | 78               | 85               | Ditto.           | Fair A. M. thunder and rain P. M.                 |
| 31    | 29.8               | 28.9               | 28.7               | 72 $\frac{1}{2}$ | 72               | Variable.        | Dull rainy day.                                   |

Quantity of rain in July, 2.95 } Inches.

Quantity of water evaporated, 4.60 }

\* This observation was taken at 1 $\frac{1}{4}$  P. M. The thermometer being hung in a shade in the open air.

AUGUST, 1772.

| Days. | Barometer. |       | Thermometer. |     | Winds.                 | Weather.                                    |
|-------|------------|-------|--------------|-----|------------------------|---|
| 1     | 29.5       | 29.5  | 65           | 64½ | N. W.                  | Flying clouds, with bright intervals.       |
| 2     | 29.9½      | 30.1  | 66           | 69½ | W.                     | Fine pleafant weather.                      |
| 3     | 30.3½      | 30.3  | 65           | 69  | Ditto, little.         | Ditto.                                      |
| 4     | 30.2       | 30.2  | 64           | 71½ | S.                     | Ditto.                                      |
| 5     | 30.1½      | 29.6  | 67           | 70  | N.                     | Heavy showers; clears up in the night.      |
| 6     | 29.7       | 29.6½ | 71           | 82  | S. W.                  | Fair weather.                               |
| 7     | 29.7       | 29.7  | 75           | 83  | Ditto.                 | Ditto.                                      |
| 8     | 29.7       | 29.3  | 76           | 86  | Ditto.                 | Fair day; terr. thun. & lightg. in the nig. |
| 9     | 29.4       | 29.5  | 78           | 75  | Variable.              | Cloudy A. M.; fair P. M.                    |
| 10    | 29.6       | 29.6  | 65           | 66  | N. E. little.          | Cloudy day; small showers in the even.      |
| 11    | 29.5       | 28.6½ | 67           | 81  | Variable.              | Unfettled weather.                          |
| 12    | 28.9       | 28.9  | 62           | 79  | S. W.                  | Fair and pleafant.                          |
| 13    | 29.2       | 29.2  | 70           | 80  | Ditto.                 | Ditto.                                      |
| 14    | 29.5       | 29.5  | 74           | 80½ | Ditto.                 | Ditto.                                      |
| 15    | 29.5       | 29.4  | 75           | 84½ | S. A. M. showers P. M. | Fair A. M. showers P. M.                    |
| 16    | 29.4½      | 29.4  | 72           | 72  | N. E.                  | Dull cloudy day.                            |
| 17    | 29.5       | 29.5  | 65           | 68  | Ditto.                 | Cloudy day; rain in the night.              |
| 18    | 29.5       | 29.4  | 60½          | 63½ | Ditto.                 | Dull rainy weather.                         |
| 19    | 29.6       | 29.6  | 59½          | 59  | S. to N. E.            | Unfettled weather.                          |
| 20    | 29.8       | 29.5½ | 63½          | 64½ | Variable.              | Ditto.                                      |
| 21    | 29.9       | 29.8  | 63           | 67½ | W.                     | Fine pleafant weather.                      |
| 22    | 29.9       | 29.8  | 62½          | 71  | S. W.                  | Ditto.                                      |
| 23    | 29.5       | 29.3½ | 67           | 74  | Ditto.                 | Fair A. M. small showers P. M.              |
| 24    | 29.8½      | 29.9½ | 66           | 62½ | N. E. to E. little.    | Fine pleafant day.                          |
| 25    | 29.9½      | 29.9  | 58           | 67  | E.                     | Cloudy day; heavy showers in the night.     |
| 26    | 28.3½      | 28.2½ | 65           | 75½ | S. strong.             | Flying clouds, with bright intervals.       |
| 27    | 29.2       | 29.2  | 72           | 75  | Ditto, little.         | Fine pleafant day.                          |
| 28    | 29.2½      | 28.8½ | 73           | 71  | W.                     | Ditto.                                      |
| 29    | 29.6½      | 29.7  | 72           | 69  | Ditto.                 | Ditto.                                      |
| 30    | 29.9½      | 30.0  | 62           | 74  | Ditto.                 | Ditto.                                      |
| 31    | 30.3       | 30.3  | 62           | 67½ | S. W. little.          | Ditto.                                      |
|       | 30.1       | 29.9  | 63           | 76  |                        |   |

Quantity of rain in August, 3.15 } Inches.  
Quantity of water evaporated, 4.35 }

# METEOROLOGICAL OBSERVATIONS. 131

SEPTEMBER, 1772.

| Days. | Barometer.         |                    | Thermometer.     |                  | Winds.              | Weather.                                   |
|-------|--------------------|--------------------|------------------|------------------|---------------------|--|
| 1     | 29.6               | 29.6 $\frac{1}{2}$ | 71               | 75               | E. little.          | Fair pleasant weather.                     |
| 2     | 29.7               | 29.8 $\frac{1}{2}$ | 67               | 69               | N. to N. E.         | Cloudy day; storm of rain in the night.    |
| 3     | 29.2 $\frac{1}{2}$ | 29.2               | 67 $\frac{1}{2}$ | 68               | N. fresh.           | Rainy till 4 P. M. clears up in the night. |
| 4     | 29.7 $\frac{1}{2}$ | 29.8               | 68 $\frac{1}{2}$ | 81 $\frac{1}{2}$ | W.                  | Fine pleasant day.                         |
| 5     | 30.1               | 30.0 $\frac{1}{2}$ | 67               | 70               | Ditto.              | Ditto.                                     |
| 6     | 30.1               | 30.1               | 53               | 61               | Ditto.              | Ditto.                                     |
| 7     | 30.1               | 29.8 $\frac{1}{2}$ | 57               | 67 $\frac{1}{2}$ | W. to S.            | Fair A. M. cloudy P. M.                    |
| 8     | 29.6               | 29.8               | 64               | 64               | S. to W.            | Cloudy day; fair evening.                  |
| 9     | 29.6               | 29.7 $\frac{1}{2}$ | 65               | 73               | S.                  | Cloudy dull weather.                       |
| 10    | 29.4               | 29.4               | 58 $\frac{1}{2}$ | 55               | N. strong.          | Rainy day; fair evening.                   |
| 11    | 29.1               | 29.1 $\frac{1}{2}$ | 52               | 57 $\frac{1}{2}$ | N. to W.            | Storm of rain all day.                     |
| 12    | 29.1 $\frac{1}{2}$ | 29.1 $\frac{1}{2}$ | 50               | 51               | W. little.          | Rainy A. M. cloudy P. M. fair evening.     |
| 13    | 29.8 $\frac{1}{2}$ | 29.9               | 51               | 58               | W. to S. W. little. | Fine pleasant day.                         |
| 14    | 30.0               | 30.0               | 52 $\frac{1}{2}$ | 68               | W.                  | Ditto.                                     |
| 15    | 30.0               | 29.9               | 58               | 60 $\frac{1}{2}$ | W. to N.            | Ditto.                                     |
| 16    | 29.9               | 29.8               | 51               | 57               | S. to W.            | Fair A. M. cloudy P. M. rain in the night. |
| 17    | 29.4 $\frac{1}{2}$ | 29.3               | 55               | 57               | W. to W.            | Rainy day; fair evening.                   |
| 18    | 29.5               | 29.5               | 58               | 65               | W. little.          | Fair day.                                  |
| 19    | 29.8               | 29.8 $\frac{1}{2}$ | 54               | 66 $\frac{1}{2}$ | Ditto.              | Ditto.                                     |
| 20    | 29.8               | 29.7 $\frac{1}{2}$ | 59               | 64               | S. little.          | Ditto.                                     |
| 21    | 29.8               | 29.8               | 62 $\frac{1}{2}$ | 63               | Ditto.              | Ditto.                                     |
| 22    | 29.8               | 29.8 $\frac{1}{2}$ | 55               | 62 $\frac{1}{2}$ | S. to E.            | Ditto.                                     |
| 23    | 29.4 $\frac{1}{2}$ | 29.4               | 62               | 64 $\frac{1}{2}$ | N.                  | Rainy day.                                 |
| 24    | 29.6 $\frac{1}{2}$ | 29.6 $\frac{1}{2}$ | 59 $\frac{1}{2}$ | 57               | Ditto.              | Cloudy dull weather.                       |
| 25    | 29.8               | 29.8               | 57               | 61               | Ditto.              | Flying clouds, with bright intervals.      |
| 26    | 29.8               | 29.8               | 49               | 52               | Ditto.              | Fair weather.                              |
| 27    | 29.9               | 29.9 $\frac{1}{2}$ | 52               | 59               | N. to E.            | Ditto.                                     |
| 28    | 29.9               | 29.9               | 59               | 65               | S. to S. W.         | Fine bright day.                           |
| 29    | 29.7               | 29.7               | 59               | 60               | E.                  | Dull mulling day.                          |
| 30    | 29.7               | 29.7               | 57               | 59               | Ditto.              | Ditto.                                     |

Quantity of rain in September, 2.95 } Inches,  
Quantity of water evaporated, 4.50 }

OCTO-

OCTOBER, 1772.

| Days. | Barometer. |       | Thermometer. |     | Winds.        | Weather.                                       |
|-------|------------|-------|--------------|-----|---------------|--|
| 1     | 29.7       | 29.7  | 56           | 58½ | N.            | Dull cloudy day.                               |
| 2     | 29.7½      | 29.6½ | 56½          | 63  | W.            | Fine plea. day. <i>Aur. Ber.</i> in the night. |
| 3     | 29.8½      | 29.8½ | 52           | 51  | Ditto.        | Ditto.   |
| 4     | 29.9½      | 30.0  | 43           | 54  | Ditto.        | Fair weather.                                  |
| 5     | 30.0       | 29.9½ | 47½          | 57  | S. little.    | Dull cloudy day.                               |
| 6     | 29.9½      | 29.8½ | 53           | 59  | N. E.         | Storm of rain all day.                         |
| 7     | 29.7½      | 29.6½ | 57½          | 55  | N.            | Ditto.   |
| 8     | 28.8       | 28.6  | 53           | 54  | Ditto.        | Dull mifling day.                              |
| 9     | 28.6       | 28.8  | 54           | 56  | Ditto.        | Ditto.   |
| 10    | 29.2       | 29.2  | 54½          | 57½ | Ditto.        | Fair pleasant weather.                         |
| 11    | 29.6½      | 29.6½ | 54           | 60  | W. little.    | Ditto.   |
| 12    | 29.8½      | 29.8½ | 54           | 62  | S. W. little. | Ditto.   |
| 13    | 30.0       | 30.0  | 53½          | 53  | W. N. W.      | Ditto.   |
| 14    | 30.0½      | 30.0  | 46           | 55  | Ditto.        | Ditto.   |
| 15    | 30.0½      | 30.0  | 50           | 55½ | Ditto.        | Ditto.   |
| 16    | 30.2       | 30.2  | 54           | 62  | E. to N. W.   | Ditto.   |
| 17    | 30.0½      | 30.0  | 55           | 62  | W. to S. E.   | Cloudy dull day.                               |
| 18    | 29.7½      | 29.7½ | 56½          | 59  | Variable.     | Fine pleasant day.                             |
| 19    | 29.7       | 29.6½ | 60           | 65  | S. W. little. | Cloudy A. M. mifling P. M. & in the nig.       |
| 20    | 29.2       | 29.2  | 57           | 61  | N. E. little. | Cloudy A. M.; rainy P. M.                      |
| 21    | 29.3       | 29.2½ | 56½          | 52  | N.            | Fair weather.                                  |
| 22    | 29.2       | 29.2  | 48½          | 50  | W.            | Fine pleasant day.                             |
| 23    | 29.4       | 29.4  | 42½          | 49  | W. to S. W.   | Ditto.   |
| 24    | 29.4½      | 29.4  | 42           | 53½ | S. W. fresh.  | Cloudy A. M.; fair P. M.                       |
| 25    | 29.4       | 29.3  | 53           | 58½ | S. W.         | Fine pleasant day.                             |
| 26    | 29.3       | 29.5½ | 52½          | 57½ | N. E. fresh.  | Clo. day; flo. of ra. P. M. & in the nig.      |
| 27    | 29.6       | 29.4½ | 50           | 48  | N. E.         | Cloudy with some rain.                         |
| 28    | 29.2       | 29.2  | 49           | 49  | S. W.         | Dull cloudy weather.                           |
| 29    | 29.2½      | 29.2  | 48½          | 52  | S. E. fresh.  | Cloudy A. M.; rain P. M. & in the nig.         |
| 30    | 29.1       | 29.1  | 47½          | 51  | N. W. fresh.  | Flying clouds with bright intervals.           |
| 31    | 29.4       | 29.5½ | 50           | 52½ | N. W. fresh.  |  |

Quantity of rain in October, 6.70 } Inches.  
Quantity of water evaporated, 3.75 }

NOVEM.



# METEOROLOGICAL OBSERVATIONS. 133

NOVEMBER, 1772.

| Days. | Barometer.         |                    | Thermometer.     |    | Winds.             | Weather.                               |
|-------|--------------------|--------------------|------------------|----|--------------------|--|
| 1     | 29,6               | 29,7               | 48               | 53 | S. W. little.      | Fine pleasant day.                     |
| 2     | 29,7 $\frac{1}{2}$ | 29,6               | 47 $\frac{1}{2}$ | 53 | S. E.              | Fair A. M; clo. P. M. sho. in the nig. |
| 3     | 29,7               | 29,7               | 50               | 51 | N. W. fresh.       | Fair and pleasant.                     |
| 4     | 29,6               | 29,6               | 42               | 52 | S.                 | Ditto.                                 |
| 5     | 29,6               | 29,6               | 42               | 42 | N. W. fresh.       | Ditto.                                 |
| 6     | 29,9               | 29,9 $\frac{1}{2}$ | 35               | 39 | Ditto.             | Ditto.                                 |
| 7     | 30,0 $\frac{1}{2}$ | 30,0 $\frac{1}{2}$ | 37 $\frac{1}{2}$ | 45 | S. little.         | Ditto.                                 |
| 8     | 30,1 $\frac{1}{2}$ | 30,3               | 40               | 48 | W. little.         | Ditto.                                 |
| 9     | 30,4 $\frac{1}{2}$ | 30,5               | 40               | 47 | S. E. little.      | Ditto.                                 |
| 10    | 30,2 $\frac{3}{4}$ | 30,0               | 45               | 49 | S. fresh.          | Cloudy dull weather.                   |
| 11    | 29,8 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 47               | 48 | N. W. fresh.       | Fair weather.                          |
| 12    | 30,0 $\frac{1}{2}$ | 30,0               | 38               | 42 | Ditto.             | Fine pleasant day.                     |
| 13    | 29,9               | 29,6 $\frac{1}{2}$ | 35               | 38 | S. E. to E. fresh. | Rainy day.                             |
| 14    | 29,5 $\frac{1}{2}$ | 29,6 $\frac{1}{2}$ | 41 $\frac{1}{2}$ | 43 | N. W.              | Fair pleasant weather.                 |
| 15    | 29,9 $\frac{1}{2}$ | 30,0               | 36 $\frac{1}{2}$ | 39 | S. W. to W.        | Ditto.                                 |
| 16    | 30,3               | 30,4               | 31               | 35 | W.                 | Ditto.                                 |
| 17    | 30,5 $\frac{1}{2}$ | 30,5               | 27               | 32 | Ditto.             | Ditto.                                 |
| 18    | 30,3 $\frac{1}{2}$ | 30,2 $\frac{1}{2}$ | 28               | 34 | S. W. to W.        | Ditto.                                 |
| 19    | 30,4               | 30,4               | 33 $\frac{1}{2}$ | 40 | Ditto.             | Ditto.                                 |
| 20    | 30,3 $\frac{1}{2}$ | 30,3 $\frac{1}{2}$ | 33               | 43 | W.                 | Ditto.                                 |
| 21    | 30,4 $\frac{1}{2}$ | 30,4 $\frac{1}{2}$ | 37               | 40 | N.                 | Dull cloudy day.                       |
| 22    | 30,3 $\frac{1}{2}$ | 30,3               | 42               | 43 | Variable.          | Ditto.                                 |
| 23    | 30,3               | 30,4               | 42               | 44 | W.                 | Fair pleasant weather.                 |
| 24    | 30,4               | 30,4               | 37               | 38 | Variable.          | Cloudy dull day.                       |
| 25    | 30,2 $\frac{1}{2}$ | 30,0               | 43               | 49 | S. E.              | Dull rainy weather.                    |
| 26    | 29,8 $\frac{1}{2}$ | 29,9               | 48               | 51 | S. E. to E.        | Ditto.                                 |
| 27    | 29,4 $\frac{1}{2}$ | 29,6 $\frac{1}{2}$ | 43               | 45 | N. E. to N. W.     | Cloudy day; fair evening.              |
| 28    | 29,7 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 38               | 41 | W. little.         | Fine pleasant day.                     |
| 29    | 30,0 $\frac{1}{2}$ | 30,0               | 42               | 43 | E. fresh.          | Cloudy with rain; stormy night.        |
| 30    | 29,7               | 29,6               | 50 $\frac{1}{2}$ | 48 | Variable.          | Cloudy day; fair evening.              |

Quantity of rain in November, 3,90 } Inches.  
Quantity of water evaporated, 2,45 }

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DECEM-

## DECEMBER, 1772.

| Days. | Thermometer.       |                    |                    |                  | Winds.           | Weather.   |
|-------|--------------------|--------------------|--------------------|------------------|------------------|--|
|       |                    |                    |                    |                  |                  |  |
| 1     | 29,8               | 29,8 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 43               | 45               | Fair day; rainy evening.                         |
| 2     | 29,8               | 29,8               | 29,7               | 47               | 47 $\frac{1}{2}$ | Rainy weather.                                   |
| 3     | 29,6               | 29,6               | 29,7 $\frac{1}{4}$ | 43               | 40 $\frac{1}{2}$ | Cloudy A. M.; fair P. M.                         |
| 4     | 29,6               | 29,8 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 38               | 35               | Fine pleasant day.                               |
| 5     | 29,9               | 29,9               | 29,9               | 34               | 36               | Ditto.   |
| 6     | 30,0               | 30,0               | 30,1               | 29 $\frac{1}{2}$ | 32               | Cloudy unpleasant weather.                       |
| 7     | 30,1               | 30,0 $\frac{1}{2}$ | 30,0               | 25               | 28               | Fair day.  |
| 8     | 29,9               | 29,9               | 29,9               | 26               | 31               | Flying clouds, with bright intervals.            |
| 9     | 29,8 $\frac{1}{2}$ | 29,9               | 29,8 $\frac{1}{4}$ | 29               | 32               | Fair A. M. clo. with small flowers P. M.         |
| 10    | 29,8               | 29,8               | 29,9               | 32               | 35               | Fine pleasant day.                               |
| 11    | 29,9               | 29,9 $\frac{1}{2}$ | 30,0               | 32               | 30               | Fair and clear.                                  |
| 12    | 30,0 $\frac{1}{2}$ | 30,1 $\frac{1}{2}$ | 30,1 $\frac{1}{2}$ | 25               | 28               | Ditto.   |
| 13    | 29,9               | 29,7 $\frac{1}{2}$ | 29,7 $\frac{1}{2}$ | 29               | 33               | Cloudy day; fair evening.                        |
| 14    | 29,8 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 30,0 $\frac{1}{2}$ | 36               | 39 $\frac{1}{2}$ | Fine pleasf. day. <i>Aur. Bor.</i> in the night. |
| 15    | 30,3               | 30,3 $\frac{1}{2}$ | 30,4 $\frac{1}{2}$ | 34 $\frac{1}{2}$ | 36               | Fair A. M. cloudy P. M.                          |
| 16    | 30,4               | 30,2 $\frac{1}{2}$ | 30,0               | 33 $\frac{1}{2}$ | 41               | Cloudy A. M.; rainy P. M.                        |
| 17    | 30,0               | 30,0               | 30,1               | 38               | 40               | Cloudy unfertile weather.                        |
| 18    | 30,2               | 30,2 $\frac{1}{2}$ | 30,2 $\frac{1}{2}$ | 39               | 40 $\frac{1}{2}$ | Ditto.   |
| 19    | 30,1 $\frac{1}{2}$ | 30,2               | 30,2 $\frac{1}{2}$ | 39               | 41 $\frac{1}{2}$ | Fine pleasant day.                               |
| 20    | 30,2 $\frac{1}{2}$ | 30,2               | 29,9               | 25 $\frac{1}{2}$ | 38 $\frac{1}{2}$ | Cloudy A. M.; rainy P. M.                        |
| 21    | 29,8 $\frac{1}{2}$ | 29,9               | 30,0 $\frac{1}{2}$ | 42               | 41 $\frac{1}{2}$ | Cloudy unfertile weather.                        |
| 22    | 30,1               | 30,0 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 38               | 44               | Ditto.   |
| 23    | 29,8               | 29,9               | 29,9 $\frac{1}{2}$ | 42               | 43               | Ditto.   |
| 24    | 30,0               | 29,9               | 29,8 $\frac{1}{2}$ | 40               | 38               | Cloudy day; snow in the evening.                 |
| 25    | 29,7 $\frac{1}{2}$ | 29,9               | 30,0 $\frac{1}{2}$ | 36               | 35               | Fine pleasant day.                               |
| 26    | 30,1               | 30,1               | 29,9 $\frac{1}{2}$ | 28               | 32               | Cloudy day; rain in the night.                   |
| 27    | 29,3 $\frac{1}{2}$ | 29,4 $\frac{1}{2}$ | 29,2               | 42               | 41               | Dull mifling day.                                |
| 28    | 29,4               | 29,6               | 29,7               | 41               | 41               | Fine pleasant weather.                           |
| 29    | 29,8 $\frac{1}{2}$ | 29,8 $\frac{1}{2}$ | 29,6 $\frac{1}{2}$ | 38               | 45 $\frac{1}{2}$ | Ditto.   |
| 30    | 29,0               | 29,6 $\frac{1}{2}$ | 29,9               | 43               | 35               | Ditto.   |
| 31    | 29,9 $\frac{1}{2}$ | 29,9               | 29,9               | 33 $\frac{1}{2}$ | 35               | Cloudy, dull weather.                            |

Quantity of rain in December, 2,15 } inches,  
Quantity of water evaporated, 3,10 }

## METEOROLOGICAL OBSERVATIONS. 135

The greatest height of the barometer this year, was on the 17th of November: The mercury was then at  $30.5\frac{2}{3}$  inches. The least height was  $28.2\frac{2}{3}$  inches on August the 26th. The thermometer on the 29th of July, rose to  $96^{\circ}\frac{1}{2}$ ; on February the 13th, it stood at  $3^{\circ}$ : The former was the greatest, the latter its least height. The quantity of rain that fell in the year was 36.30 inches. The quantity of evaporation, measured by filling the vessel once a week, came out 42.65 inches.

It is however to be observed that different methods of measuring the evaporation, will lead to different conclusions. It was because the tube was of too small a diameter, and not filled often enough, that the quantity of evaporation came out so small in 1771. The method of making the experiments being altered, the evaporation turns out very different in 1772. If the experiments could be made on the surface of a watery fluid the result would determine the quantity of evaporation, with much greater certainty and accuracy, than can ever be done by means of a vessel suspended in the air.

## OBSERVATIONS IN 1773

The quantity of rain which fell in

|              |      |
|--------------|------|
| January, was | 1,95 |
| February,    | 0,95 |
| March,       | 1,75 |
| April,       | 1,90 |
| May,         | 2,10 |
| June,        | 1,70 |
| July,        | 1,00 |
| August,      | 4,15 |
| September,   | 1,05 |
| October,     | 4,10 |
| November,    | 1,90 |
| December,    | 4,00 |

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To

## 136 METEOROLOGICAL OBSERVATIONS.

To measure the quantity of *rain*, I fixed a tube about three inches diameter, in such a manner as to receive the rain as it fell; which I measured as soon as it was over, and added up the whole of each month together. In this account the *snow* and *hail* are included: These were measured by taking up in the tube all the snow or hail that fell on a space equal to its surface, and then melting it. The method of measuring the quantity of *evaporation* by a tube suspended in the air being uncertain and inaccurate, those observations are omitted.

The greatest height of the barometer this year, was on the 22d and 23d of February: The mercury at 12<sup>h</sup> on each of these days, was at 30.6 inches. The least height was 28.6 $\frac{1}{2}$  inches, on December 26th at 12<sup>h</sup>. The thermometer on the 8th of July, at 12<sup>h</sup> $\frac{3}{4}$ , rose to 96° $\frac{1}{2}$ : On February the 22d, at 8 $\frac{1}{4}$  A. M. it stood at 9° $\frac{1}{2}$  below 0. At both these times the thermometer was hung in the open air, in a shade: The former was the greatest, the latter its least height. The quantity of rain this year amounted to 26.55 inches.

On the 17th of July there was an *Aurora*, uncommon in this respect, that there were several appearances of it in the *south*: The first of these was about 9<sup>h</sup>. It began about 20° above the horizon and instantly spread itself in a horizontal direction to the distance of 30° each way from the meridian. For the space of one quarter of an hour there were five such appearances, all in the south as before; their duration was not more than half a minute, and their colour a pale light, exactly like that of the Aurora in the north.

There was also a remarkable HURRICANE this year, the effects of which were principally felt at *Salisbury*, *Amesbury*, and *Haverhill*. These towns lie on Merrimack river, on the north side; Salisbury being the place where the river empties itself into the ocean.

The

## REMARKABLE HURRICANE. 137

The hurricane came on *August* 14th, 1773. Its *rise* was very sudden, and without any previous uncommon appearance in the sky, or other symptom of its approach. In the morning there was a light breeze of wind at the east, attended with plentiful showers. At 7<sup>h</sup>  $\frac{3}{4}$  the wind veered about to south-east, where it became a brisk gale. In about two minutes, it got into the south-west, and became on a sudden very violent. From thence in about two minutes more, it shifted to west-north-west, and then suddenly died away to a moderate breeze. While the wind was thus changing, it seemed to blow in every direction; the gusts became very violent, and formed many little whirlwinds all around, attended with a very heavy shower of rain, and an uncommon darkness.

At the place where *Salisbury* and *Amesbury* join, the *violence* of the hurricane was very great. Its first appearance was on Merrimack river. At the time when the wind was veering to the south-east, its waters seemed to be instantly thrown into a violent agitation; and came rolling from the east as if they would have overflowed the banks. The hurricane immediately struck the shore at Salisbury-Point and Amesbury, levelling before it several well built houses almost new, unroofing, twisting, and wrecking others; and thus tearing down, or shattering most of the buildings that were in its way. Several buildings were shattered to pieces, and others removed in an instant. A sail-maker's loft in which a man was sitting, was carried away and dispersed in a moment; the unhappy man being found senseless at the distance of 94 feet from the place where the loft stood. A large oak post 14 feet in length and 11 inches in diameter, was taken up and carried by the wind 138 feet. Two new vessels of 90 tons burthen, were lifted up from the blocks and carried to the distance of 22 feet. And a large bundle of shingles was taken up from the earth and thrown near 330 feet, in a direction contrary to that of the post and vessels. The trees around  
were

were torn up, the fences were thrown down, scattered or carried off, and the various kinds of lumber that lay dispersed on the shore, were whirled about in different directions, and to different distances. Some houses and vessels that seemed the most exposed to the wind, suffered nothing at all; and others that seemed to be the least exposed, were much damaged or carried off. The number of buildings that suffered was about 120: And though many persons were carried to some distance, and others much hurt, being covered in the ruins or in the cellars of their houses, no lives were lost. At the place where this destruction was done, the buildings were pretty thick, amounting to about 150. The general *direction* of the hurricane was from east-south-east to west-north-west. Its *extent*, in width, was about a quarter of a mile; in length, about a mile and three quarters: And its *duration*, not more than four minutes from the time it first began till all became still and quiet again.

At the same time considerable damage was done at *Haverhill*, ten miles higher up the river. There the hurricane came on from the south-west. Its first effect was the destruction of a large new barn. The barn containing a large quantity of hay and grain, was crushed down in an instant. The hay, boards and shingles were scattered round to all points of the compass, to the distance of four or five rods from the place where the barn stood; and some of them were carried to the distance of three miles north-east. A large dwelling house at eight or ten rods distance, was much damaged; every board and rib was torn from the roof, and the chimney wrecked to the foundation. Five barns were almost wholly destroyed, and a number of houses and other buildings were much damaged. In some, the windows and doors were drove in; in others, the boards and shingles were ripped off and scattered in all directions. The stone walls in some places were almost levelled with the ground; and the trees to the  
number

number of five hundred were swept off in the space of a mile. The general *direction* of the hurricane was different here from what it was in Salisbury, being from south-west to north-east. Its *extent* was about three miles in length, and half a mile in width: Its *duration* not more than four minutes. The *violence* of the hurricane was probably as great at Haverhill, as it was at Salisbury: But as it passed half a mile above or north-west of the centre of the town, where the buildings were not very thick, the damage done by it was much less.

To what *extent* the disturbance in the atmosphere reached, cannot be exactly determined. Though it did not form whirlwinds of such force as to produce any remarkable effects at any other places but those mentioned above, it evidently extended to all the towns on Merrimack river, from the mouth to some miles above Haverhill. In all the adjacent towns, the sudden change and different directions of the wind, with their effects in twisting the trees, corn, &c. were observed to the distance of six or eight miles on each side of the river. And yet there did not seem to be any very great alterations in the *weight* or *temperature* of the atmosphere, at any considerable distance from the place where the winds were so violent. At *Bradford* opposite to Haverhill, and not more than a mile from the place where the damage was done, the *barometer* at 7<sup>h</sup> A. M. stood at  $29,8\frac{1}{2}$  inches. At the time of the hurricane it suddenly fell to  $29,6\frac{1}{4}$ ; and just after to  $29,5\frac{3}{4}$ , which was its least height that day. By noon it rose to  $29,7\frac{1}{2}$ , and at 9<sup>h</sup> P. M. it got up to  $29,8\frac{1}{4}$ ; alterations very common in this part of America. *Fahrenheit's thermometer* in the morning was at  $74^{\circ}$ ; at noon and 9<sup>h</sup> P. M. it was one degree lower: The wind continuing very moderate between west and north-west from 8<sup>h</sup> A. M. till night.

From these phenomena we may form some probable conjectures as to the *cause* and *origin* of the hurricane. What occasioned such a violent irregular commotion in the  
air,

air, was probably the great *rarefaction* of it. The weather, for a week before, had been uncommonly hot, and the wind constantly at south or south-west. The air next to the surface of the earth must therefore have been greatly heated and rarefied; and probably was become specifically lighter than the air in the higher regions. The consequence would be that the lighter rarefied air would ascend, while the heavier condensed air would descend; and in this way the *equilibrium* of the air would be destroyed: To the place where the equilibrium of the air was thus broken, the adjacent air would instantly flow on every side as to a common centre; forming eddies and whirlpools, and thus assuming a *circular motion*. And this it is probable gave rise to those sudden changes, different directions, and violent gusts of the wind. The place where this circular motion began, seems to have been in the upper region of the air, at some distance from the surface of the earth; for several of the effects of the hurricane bear the marks of a *descent*. At the place where it first struck Merrimack river, it hove up the waters, as if some great force had been impressed upon its surface: And at Haverhill, where it was first felt it crushed a barn to pieces as if some immense weight had fallen upon it. When the descending air and whirl came to the earth, being stopped in its descent it seems to have instantly spread itself in to a larger circle or compass, blowing every way from the centre. And hence the pieces of the barn that was crushed down by it, became scattered to the distance of four or five rods all around. A descent of the air in one place would be immediately succeeded with an *ascent* of it in another. And thus the whirlwind, where the air was descending crushed down the buildings before it: But where the air was ascending, lifted up, unroofed, or carried them away; shattering and throwing off the materials thus carried up, as they came to the extremity of the whirl, in tangent lines, to different distances and in all directions. Besides this circular, the whirl-

winds



## METEOROLOGICAL OBSERVATIONS. 141

winds had also a *progressive* motion. Had the different winds by which the whirlwinds were formed been of equal violence, the whirlwinds would have been stationary consisting only of a circular motion; but being of unequal violence, the whirlwinds had a progressive motion, proceeding in different directions at different places, according to the direction of the strongest wind.

The *summer* preceding this hurricane had been in some respects different from what is common in this part of the country. There had been an uncommon drought for two months before, which was no where more severe than in the towns upon the river; and in no summer for several years, have we had so much hot weather. This circumstance is agreeable to the presumption of theory; for, if whirlwinds and hurricanes are derived from the great rarefaction of some part of the atmosphere, it might be expected that the times in which they would happen, would be in the most calm, or hot weather.

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### N° X.

*A Letter from J. MADISON, Esquire, to D. RITTENHOUSE, Esquire.*

DEAR SIR,

William and Mary College, Virginia, November, 1779.

AGREEABLY to promise, I now transmit you a series of observations upon our climate. They comprehend an entire year, and part of the succeeding. I thought once of sending you only a mean of the observations for each month, but as it was a part of our natural history, which has never yet been made public, I have therefore sent a copy of the journal. Some singular cir-

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cumstances